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Lockheed

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March 7, 1988

EA955/88

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Executive Officer
California Regional Water
Quality Control Board
Los Angeles Region
107 South Broadway, Suite 4027
Los Angeles, California 90012-4596

Subject: LASC Site Assessment and Remediation Program

Plant A-1 (I.D.# 91500016) Plant B-6 (I.D.# 91500025) Plant B-1 (I.D.# 91500034) Plant C-1 (I.D.# 91500043)

Reference: (a) LASC Groundwater Monitoring Program

(b) Cleanup and Abatement Order No. 87-161 Rev., 12/22/87

Dear Dr. Ghirelli:

Transmitted herewith are enclosures related to the cited tasks currently being performed under the subject program.

Task 1 - Soil Gas Survey

Enclosure (1): Report on Phases 4, 5, and 6 of the Soil Gas Survey

This report is submitted in accordance with LASC's Soil-Gas Survey Work Plan, revised 12/16/87. Reports on Soil-Gas Survey Phases 1 and 2 were submitted on February 12, and February 22, 1988, respectively. Report on Phase 3 is currently in preparation and will be submitted to the Board by March 31, 1988.

Dr. Robert P. Ghirelli March 7, 1988 Page 2

Task 3 - Installation of Additional Groundwater Monitoring Wells

Enclosure (2): Groundwater Monitoring Wells Location Maps (Figures 1 and 2)

By letter of January 6, 1988, the Board granted approval to proceed with the installation of monitoring wells in three of the five locations at Plants A-1, B-1, and B-6 identified as areas 1, 2, and 3 on the map submitted on December 30, 1987 per para 1.A.1. of the reference (b) order.

Maps showing the specific placement of the cluster wells within areas 1 and 3 were provided to the Board on February 5 and 22, 1988, respectively. The locations of the cluster wells to be installed within area 2 are depicted on Figure 2.

The Soil Gas Survey Data, comments received from the Board and other agencies on the Phase 2 Groundwater Monitoring Program report and other pertinent soil and groundwater information are currently being evaluated. This evaluation will assist in the preparation of the detailed work plan for the additional groundwater monitoring wells to be installed to complete the comprehensive site assessment. This work plan will be delivered on March 31, 1988 as directed by Para 1.A.1. of the Reference (b) order.

If you have any questions, please call Mr. Don Urquhart at (818) 847-5024

Sincerely, Lockheed Aeronautical Systems Company

E. Lloyd Graham

Executive Vice President

ELG:DU:CR

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 File 1.2.1/C

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COMPREHENSIVE SITE ASSESSMENT AND REMEDIATION PROGRAM

LOCKHEED AERONAUTICAL SYSTEMS COMPANY BURBANK

TASK 1 SOIL GAS SURVEY

Reports on:

- Phase 4 Evaluation of Possible Contamination to the West and South of LASC
 - Phase 5 Evaluation of Contamination at Other Suspect LASC Locations
 - Phase 6 Evaluation of Other Areas of the LASC Facility

Submitted to:

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

LOS ANGELES REGION

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ACKNOWLEDGMENTS

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ABBREVIATIONS AND ACRONYMS

California Regional Water Quality Control Board **CRWQCB** DCA Dichloroethane **DCE** Dichloroethene Gas chromatography/electron capture detector Gas chromatography/flame ionization detector GC/ECD GC/FID Lockheed Aeronautical Systems Company **LASC PCE** Perchloroethene Parking Lot P.L. Quality assurance QA **SVE** Soil vapor extraction 1,1,1 - Trichloroethane **TCA** TCE Trichloroethene THC Total hydrocarbons Tracer Research Corporation, Inc. TRC ug/L Microgram per liter Volatile organic compound VOC

SECTION 1

INTRODUCTION

1.1 BACKGROUND

Lockheed Aeronautical Systems Company (LASC) is currently engaged in a comprehensive site assessment and remediation program covering its Burbank facilities. The program has as its overall objective the systematic identification and remediation of soil and groundwater contamination detected beneath Lockheed facilities. Using the protocols developed by regulatory agencies for site characterization and assessment, the program seeks to:

- o Identify the source(s) and assess the nature and extent of contamination
- o Develop a sound basis for assessment of remedial alternatives
- o Design and implement remedial measures

Source identification and assessment include soil-gas surveying, records search, and installation and sampling of groundwater monitoring wells. In order to perform the soil-gas survey in a systematic and flexible fashion, a phased approach was used which allowed for adjustment to the field plan to take into account information as it was generated in the survey. The phased approach also allowed prioritization of the specific areas that were to be characterized and adjustment of the intensity of the characterization desired for a specific area (e.g., LASC's Building 175). The soil-gas survey implemented at the Burbank facility consisted of the following phases:

- Phase 1 Feasibility Evaluation and Scoping
- Phase 2 Assessment of the Horizontal Extent of Soil Contamination
 - Building 175
- Phase 3 Building 175 Confirmation Sampling and Vertical Characterization
- Phase 4 Evaluation of Possible Contamination to the West and South of
 - LASC
- Phase 5 Evaluation of Contamination at Other Suspect LASC Locations
- Phase 6 Evaluation of Other Areas of the LASC Facility

Detailed descriptions of the objectives of and the areas and activities in each phase can be found in the work plan for the soil-gas survey task which was submitted to the California Regional Water Quality Control Board (CRWQCB) on December 14, 1987 (1).

Field activities for all phases of the program have been completed. Reports on Phases 1 and 2 of the investigation were submitted to the CRWQCB on February 12 and February 22, 1988, respectively (2, 3). This document presents the results of the Phases 4, 5, and 6 of the investigation; Phase 3 report is currently in preparation and is scheduled to be submitted to the CRWQCB by March 31, 1988. Phase 1 investigation established that soil-gas surveys can be used to estimate the areal extent and volatile organic compound (VOC) composition of soil contamination at the LASC facility. The results also indicated that soil-gas sampling can be used to identify unknown source areas based on predetermined sampling grids and on VOC

concentrations which exceed 100 ug/L level. Practical depths for obtaining soil-gas samples were also established.

1.2 SIGNIFICANCE AND INTERPRETATION OF SOIL-GAS RESULTS

Soil-gas surveying is a reconnaissance tool for identifying suspect contamination areas and for approximating the areal extent of subsurface contamination. Both the magnitude of VOC concentrations in soil-gas and the steepness of observed horizontal gradients can provide useful information regarding subsurface contamination. Based on studies reported by Marrin and Thompson (4) and Evans and Thompson (5), elevated (above about 100 ug/L) concentrations of TCE or PCE in soil gases are usually indicative of sampling within, above, or laterally adjacent to soil contamination. A relatively steep concentration gradient is frequently present in the immediate vicinity of soil contamination. Soil-gas concentrations of approximately 1 to 100 ug/L are commonly detected in soil-gas samples further away from the contaminated soil.

The theory behind soil-gas surveying and its capabilities and limitations have been discussed in the work plan for this task (1). As discussed in the work plan, an understanding of the applications and limitations of the technique is essential for proper site-specific interpretation of the soil-gas data. In the absence of barriers to gas diffusion (e.g., a dense clay layer overlying contaminated soil or groundwater), very low VOC concentrations (less than about 1 ug/L) in the soil-gas may imply the absence of a nearby source of contamination. The detection of elevated VOC levels (greater than about 100 ug/L) in the gas samples implies either soil contamination at or near the sampling points or VOC migration from a distant source(s) along high permeability conduits. Utility trench backfills, building foundations, areas immediately beneath paved surfaces, etc., can serve as such high permeability channels which permit the diffusion of vapors to uncontaminated areas. Thus, the soil-gas "plume" is not necessarily the same as, and is frequently larger than, the actual area of contamination. In addition, soil-gas survey results do not provide any information about the vertical extent of contamination.

The correlation of the soil-gas "plume" with the actual extent of soil contamination (both areal and vertical) at the LASC facility is being evaluated in Phase 3 of this task, which includes confirmatory drilling and soil-sampling around Building 175 in Plant B-1. A records search task has also been initiated to compile information on past chemical handling and disposal practices and on locations and construction of the underground utility corridors. This information is expected to assist in the interpretation of the soil-gas data and to supplement soil-gas results in planning confirmatory studies.

Soil-gas surveying has provided a rapid and cost-effective method for identifying areas of potentially contaminated soil which can be confirmed via the more expensive conventional methods of soil boring, sampling, and chemical analysis. In the present program, the soil-gas technique has permitted reconnaissance of some very large, and otherwise unaccessible, areas of the LASC facility within a relatively short time frame.

1.3 ANALYTICAL METHODS

Analysis of soil-gas samples was performed by gas chromatography/electron capture detection (GC/ECD) for chlorinated solvents and by gas chromatography/flame ionization detection (GC/FID) for total VOCs. The total GC/FID signal is reported and discussed in this report as "total hydrocarbons (THC)" but can include oxygenated solvents such as methyl ethyl ketone or methyl isobutyl ketone.

SECTION 2

PHASE 4 INVESTIGATION

2.1 OBJECTIVES OF PHASE 4

The major objective of the Phase 4 soil-gas investigation was to identify possible soil contamination in areas located to the west and south of LASC, including Plant C-1 and portions of the Burbank-Glendale-Pasadena Airport (see Figure 1). A secondary objective was to assess the possible influence of perchloroethylene (PCE) and 1,1,1-trichloroethane (TCA) in ambient air on shallow soil-gas samples. The relationship between VOC concentrations in soil-gas and in ambient air will be important in assessing whether soil-gas concentrations in the 0.001 to 1.0 ug/L range can be used as an indication of groundwater contamination.

During the Phase 4 investigation, soil-gas was collected and analyzed from a total of 63 points in the vicinity of Plant C-1 and the Burbank-Glendale-Pasadena Airport (see Figure 1 for sampling locations). The average spacing between sampling points during this phase was 300 to 500 feet, which was selected for purposes of source identification rather than for source delineation.* Soil-gas samples were collected at the 4-foot depth except at points A04 and A40, where probes could not be driven past 3 feet and 2 feet, respectively.

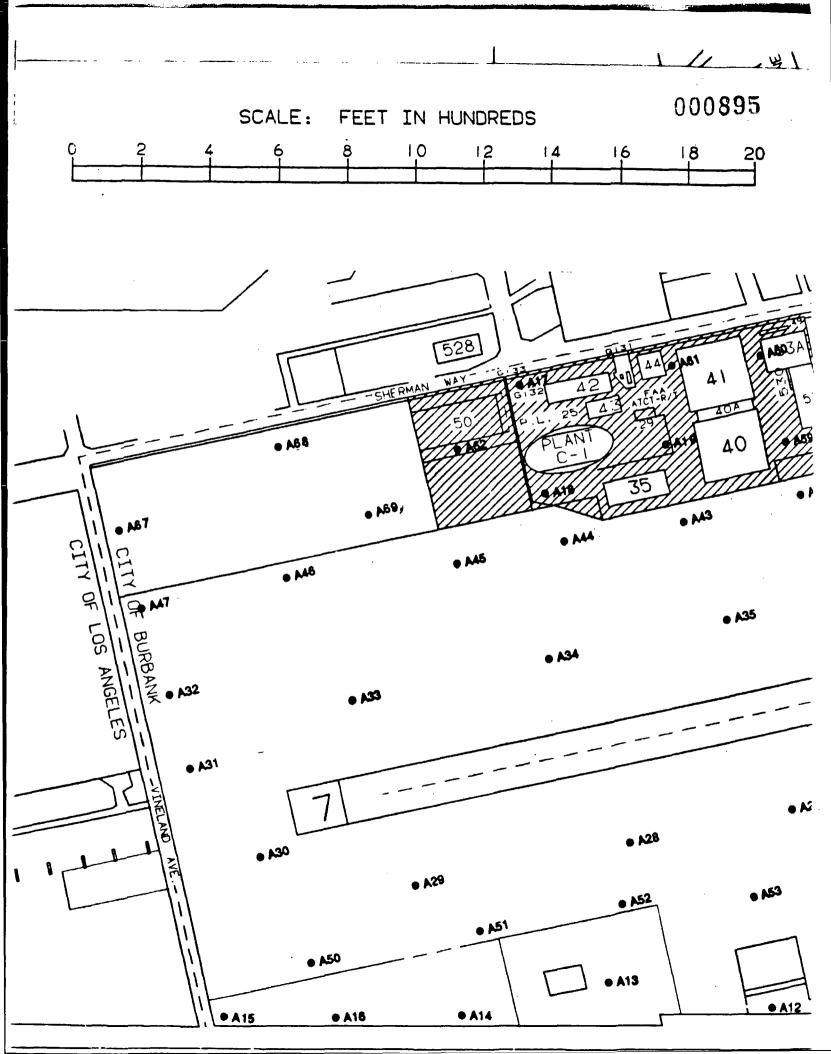
2.2 DISCUSSION OF PHASE 4 RESULTS

A summary of the soil-gas sampling results for the Phase 4 investigation is presented in Table 1.

2.2.1 PCE Distribution

The highest perchloroethene (PCE) concentration within the Phase 4 study area was located near the western end of Runway 7 (i.e., 18 ug/L at point A50). PCE appears to have migrated toward the south, west, and northwest where PCE concentrations ranged from 0.2 to 6 ug/L at adjacent sampling points. Although soil-gas concentrations in this range do not indicate sampling in contaminated soil, they do indicate gaseous diffusion of VOCs from a distant source.

^{*} Consistent with the soil-gas survey technology literature, the terms "source", "surface source", and "source area" used in this report refer to areas with elevated VOC concentrations in the soil-gas. This usage of the term "source" is different from the conventional usage in pollution control technology literature which implies a point discharge or emission/contamination.



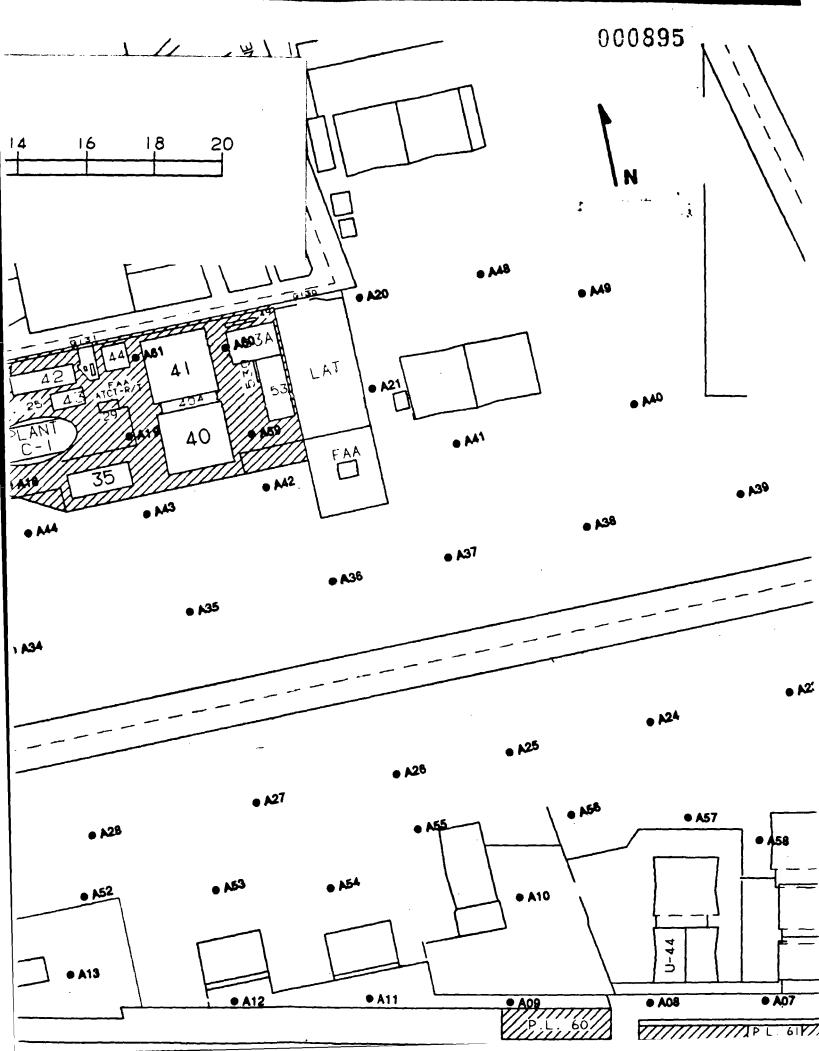


TABLE 1. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FOR PHASE 4

Sample No.	Depth (ft)		ne Toluene) (ug/L)	Tot. Xyl. (ug/L)	THC (ug/L)	TCA (ug/L)	TCE (ug/L)	PCE (ug/L)
A02	4.0	<0.04	<0.04	<0.04	N/A	0.03	<0.0003	0.03
A03	4.0	< 0.05	< 0.06	< 0.06	< 0.05	0.03	< 0.0002	0.009
A04	3.0	< 0.05	< 0.06	< 0.06	< 0.05	0.02	< 0.0002	0.003
A05	4.0	< 0.05	< 0.06	< 0.06	< 0.05	0.09	0.01	0.1
A06	4.0	<0.08	<0.08	<0.1	N/A	<0.0006	14	0.2
A07	4.0	< 0.05	< 0.06	<0.06	< 0.05	3.0	< 0.002	0.06
A08	4.0	< 0.04	<0.04	<0.04	N/A	0.06	0.09	0.009
A09	4.0	< 0.07	< 0.03	<0.04	N/A	0.04	< 0.0003	0.1
A10	4.0	< 0.04	<0.04	< 0.04	N/A	< 0.0001	< 0.0003	0.05
A11	4.0	< 0.05	<0.06	< 0.06	< 0.05	< 0.0001	< 0.0002	0.02
A12	4.0	< 0.05	<0.06	<0.06	< 0.05	0.04	< 0.0002	0.004
A13	4.0	< 0.05	< 0.06	< 0.06	< 0.05	< 0.001	< 0.002	0.06
A15	4.0	< 0.05	< 0.06	< 0.06	< 0.05	1	1.9	1.3
A16	4.0	< 0.05	< 0.06	< 0.06	1.3	2.5	3.5	5.6
A17	4.0	< 0.05	<0.06	<0.06	< 0.05	< 0.0001	0.100	0.02
A18	4.0	< 0.05	< 0.06	< 0.06	< 0.05	0.02	0.003	0.02
A19	4.0	< 0.05	< 0.06	<0.06	< 0.05	0.09	<0.0002	0.04
A20	4.0	0.1	<0.04	<0.1	N/A	0.05	<0.0003	0.7
A21	4.0	<0.08	<0.08	<0.1	N/A	0.1	0.2	0.009
A22	4.0	<0.04	< 0.05	<0.06	<0.04	0.2 0.2	0.01 0.2	<0.04 0.01
A23	4.0	<0.04	<0.05	< 0.06	<0.04 1.7	0.2	< 0.0003	0.01
A24 A25	4.0 4.0	1.4 <0.04	1.3 <0.05	<0.06	<0.04	0.1	<0.0003	0.01
A26	4.0	<0.04	<0.05	<0.06 <0.06	<0.04	0.02	<0.0003	0.02
A27	4.0	<0.04	< 0.05	< 0 .06	<0.04	0.02 N/A	<0.0003	0.02
A28	4.0	<0.04	<0.05	< 0.06	<0.04	N/A	<0.0003	0.003
A29	4.0	<0.04	<0.05	<0.06	<0.04	N/A	< 0.0003	0.007
A30	4.0	<0.04	< 0.05	<0.06	< 0.04	0.2	0.2	0.000
A31	4.0	<0.04	< 0.05	< 0.06	< 0.04	0.8	1.8	1
A32	4.0	< 0.04	< 0.05	<0.06	< 0.04	0.2	1.0	ī
A33	4.0	N/A	N/A	N/A	< 0.04	0.04	0.06	0.02
A34	4.0	N/A	N/A	N/A	< 0.04	0.05	< 0.0003	0.003
A35	4.0	< 0.04	< 0.05	<0.06	< 0.04	0.06	< 0.0003	0.003
A36	4.0	< 0.04	< 0.05	< 0.06	< 0.04	0.04	< 0.0003	0.002
A37	4.0	< 0.04	< 0.05	<0.06	< 0.04	0.1	< 0.0003	0.009
A38	4.0	< 0.04	< 0.05	< 0.06	< 0.04	0.2	< 0.0003	0.01
A39	4.0	< 0.04	< 0.05	< 0.06	< 0.04	0.06	< 0.0003	0.008
A 40	2.0	< 0.04	< 0.05	< 0.06	< 0.04	0.07	< 0.0003	0.003
A41	4.0	< 0.04	< 0.05	< 0.06	< 0.04	0.1	< 0.0003	0.01

TABLE 1. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FOR PHASE 4 (continued)

Sample	Depth	Benzer	ne Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)	(ug/L) (ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
A42	4.0	<0.04	<0.05	<0.06	<0.04	0.09	< 0.0003	0.007
A43	4.0	< 0.04	< 0.05	<0.06	<0.04	1.0	< 0.0003	0.009
A44	4.0	N/A	N/A	N/A	N/A	0.09	< 0.0003	0.000
A45	4.0	0.08	0.2	<0.01	N/A	0.6	< 0.0006	0.009
A46	4.0	0.2	0.2	< 0.01	N/A	0.06	< 0.0006	0.06
A47	4.0	< 0.04	< 0.04	< 0.5	N/A	0.01	< 0.0006	0.02
A48	4.0	0.5	0.2	< 0.1	N/A	0.08	< 0.0003	0.4
A49	4.0	0.04	0.04	< 0.1	N/A	0.0004	< 0.0003	0.00
A50	4.0	0.6	< 0.08	< 0.1	N/A	9	15	18
A51	4.0	0.1	< 0.08	< 0.1	N/A	0.002	< 0.0006	0.01
A52	4.0	0.2	< 0.08	< 0.1	N/A	0.0002	< 0.0006	0.008
A53	4.0	0.1	<0.08	< 0.1	N/A	< 0.0001	< 0.0003	0.004
A54	4.0	< 0.08	0.2	< 0.01	N/A	< 0.0001	< 0.0003	0.004
A55	4.0	0.08	< 0.8	< 0.1	N/A	< 0.0001	< 0.0003	0.09
A56	4.0	0.08	0.2	< 0.1	N/A	< 0.0008	0.02	0.01
A57	4.0	0.6	0.09	< 0.1	N/A	<0.0001	0.5	0.04
A58	4.0	4	< 0.08	< 0.1	N/A	18	2	2
A59	4.0	2	< 0.04	< 0.04	N/A	11	< 0.0003	0.4
A60	4.0	< 0.04	< 0.04	< 0.04	N/A	0.01	3	0.02
A61	4.0	< 0.04	< 0.04	< 0.04	N/A	0.1	0.1	0.02
A62	4.0	< 0.04	< 0.04	< 0.04	N/A	0.01	0.0008	0.02
A67	4.0	< 0.04	< 0.04	< 0.04	N/A	0.03	0.02	0.09
A68	4.0	< 0.04	< 0.04	< 0.04	N/A	0.1	0.2	0.03
A69	4.0	< 0.04	<0.08	< 0.04	N/A	0.03	< 0.0003	0.01

The majority of soil-gas samples collected during the Phase 4 study did not contain PCE above 0.1 ug/L suggesting that PCE contamination (if any) in the Airport and Plant C-1 area is minimal in terms of areal extent and concentration. It should be noted that all soil-gas samples in Phase 4 were collected under bare soil, as compared to less than 5% of the samples from the other sections of the LASC facility. As was explained in the Phase 1 report (2), shallow soil-gas samples collected under bare soil sometimes yield lower VOC concentrations than adjacent samples which are drawn from beneath pavement. Since all Phase 4 sampling was conducted beneath bare soil, the relative VOC concentrations are comparable among sampling points. Based on the range of VOC concentrations and relatively undisturbed surface soils within the Phase 4 study area, it is unlikely that the lower VOC concentrations measured in soil-gas in the Plant C-1/Airport area (compared to results at other LASC areas remote from soil contamination) could be solely the result of sampling under bare soil as opposed to sampling beneath pavement.

2.2.2 TCE and TCA Distribution

Similar to PCE, elevated concentrations of TCE and TCA (15 and 9 ug/L, respectively) were measured in the soil-gas samples at point A50. These data imply that minimal soil contamination by all three solvents may be present in the area between the railroad tracks and the west end of Runway 7. The distribution of TCE and TCA concentrations in this area (i.e., an approximate exponential decrease as a function of radial distance) suggests the presence of trace contamination in soil rather than gas-phase migration of VOCs along a permeable subsurface layer.

TCA concentrations above 10 ug/L were recorded at points A06, A58, and A59. Soil-gas concentrations of 3 ug/L TCE and 11 ug/L TCA were analyzed at two points in the eastern section of Plant C-1 (A59 and A60), which may indicate minimal contamination near Buildings 40 and 41. Information on previous uses of PCE, TCE and TCA in the Plant C-1/Airport area and on fate and transport of these solvents in the soil and groundwater environments is currently being collected under other tasks.

TCE was not present above the analytical detection limit of 0.0003 ug/L in soil-gas at over 60% of the points sampled during the Phase 4 study, suggesting that the area between the Airport buildings and Plant C-1 is free of soil contamination and has not been impacted by gas phase migration of TCE from near-surface sources. TCA concentrations in soil-gas between the Airport buildings and Plant C-1 were generally less than 0.1 ug/L except along an access road and drainage channel which are oriented perpendicular and parallel to Runway 7, respectively. Disturbed soils along the road or high permeability sediments along the channel may be responsible for diffusion of TCA in soil-gas.

2.2.3 Other Volatile Compounds

The GC/FID results indicated that THC were present above 1.0 ug/L at sampling points A58 (4 ug/L), A24 (2.7 ug/L), A59 (2 ug/L), and A16 (1.3 ug/L). These soilgas concentrations are low compared to those measured for chlorinated solvents, possibly because volatile hydrocarbons tend to be rapidly oxidized in the shallow soil-gas. Soil-gas surveying is more likely to produce lower concentrations for petroleum hydrocarbons than for the more refractory chlorinated solvents, assuming these two contaminant types are present in soil at similar levels.

Three soil-gas samples collected on the south side of Runway 7 (A16, A24, and A58) contained benzene and/or toluene and xylene at levels of 1 to 4 ug/L. The presence of these aromatic hydrocarbons may indicate minimal soil contamination by petroleum fuels.

2.2.4 Quality Assurance

il market

As part of their overall quality assurance (QA) program, Tracer Research Corporation routinely analyzes ambient air samples as a means of checking for cross-contamination among sampling locations. The results suggest that residual contamination in the analytical equipment was not a problem for any of the three solvents during the Phase 4 investigation; however, it appears that PCE and TCA concentrations in ambient air are consistently above 0.01 ug/L in the vicinity the Airport and Plant C-1. Mean concentrations of 0.09 and 0.02 ug/L for TCA and PCE, respectively, are in the same range as reported for other areas within the LASC facility. As stated in previous reports (2, 3), these levels of atmospheric contamination are too low to interfere with the identification or delineation of potential source areas, however, they may be responsible for soil-gas concentrations of TCA and PCE of 0.05 ug/L or less, which have been detected from sampling points throughout the facility.

The effect of air contamination on shallow soil-gas samples may have been most pronounced during the Phase 4 study because all sampling was conducted under bare soil. TCE was below detection limits at over 60% of the soil-gas sampling points, TCA was below detection at less than 15% of the sampling points, and PCE was detected at all points sampled. (Note: the three compounds had similar detection limits in the range of 0.0002 to 0.0007 ug/L). It is not likely that these results are due to differences in either the physical properties or subsurface transport among the three compounds.

2.3 PHASE 4 CONCLUSIONS

Based on the results of the Phase 4 soil-gas investigation and on the objectives for evaluating subsurface contamination, the conclusions listed below are provided. These conclusions have been or will be taken into account in the planning and implementation of the various phases of the soil-gas survey and in other tasks associated with LASC's comprehensive site assessment and remediation program.

- o Phase 4 investigation was a cost-effective method for the reconnaissance of relatively large area within a reasonably short time frame.
- o Soil-gas surveying in the vicinity of Plant C-1 and the western portion of the Burbank-Glendale-Pasadena Airport indicates that soil contamination may be present near the west end of Runway 7. This potential source, however, appears to be minimal (in terms of areal extent and VOC concentrations).
- o The Plant C-1/Airport area is relatively free of soil-gas contamination by chlorinated solvents and contains only one area, other than that near the west end of Runway 7, which shows soil-gas concentrations above background (i.e., <0.1 ug/L). This low measurement may be due to the above-ground usage of solvents.

- o Aromatic hydrocarbons (e.g., benzene, toluene and xylenes) were detected at low concentrations in soil-gas samples in the vicinity of the Airport terminal and near the southeast corner of Plant C-1. This may reflect above-ground usage of petroleum fuels.
- o The majority of soil-gas points sampled between the Airport terminal and Plant C-1 appear to be unaffected by VOC diffusion from contaminated soil or from point sources. Results obtained from these "clean" sampling points may be useful in assessing the relationship between VOC concentrations in soil-gas and in groundwater.
- o PCE and TCA concentrations of 0.02 and 0.09 ug/L, respectively, in ambient air, probably had no effect on estimating the location of potential source areas. However, these atmospheric levels may be responsible for PCE and TCA concentrations in soil-gas less than 0.05 ug/L at locations which were remote from contaminant sources.

SECTION 3

PHASE 5 INVESTIGATION

3.1 OBJECTIVES OF PHASE 5

Soil-gas survey results from Phase 1 indicated the possibility of shallow soil contamination in the vicinity of Buildings 93 and 74 at Plant A-1. The objectives of the Phase 5 study were to delineate the horizontal extent of soil contamination in areas adjacent to these Buildings and to assess possible sources of this contamination by evaluating the horizontal soil-gas concentration gradient around source areas.

During the Phase 5 investigation, soil-gas was collected and analyzed from a total of 64 locations in the vicinity of Buildings 69, 70, 74, 75, 80, and 93 within the A-1 facility (see Figure 2 for sampling locations). The target sample depth was 4 feet, however, probes could not be driven past the 2-foot depth at 12 locations, due to hard material encountered beneath the building concrete slabs. Approximately half of the points were sampled above the target depth of 4 feet.

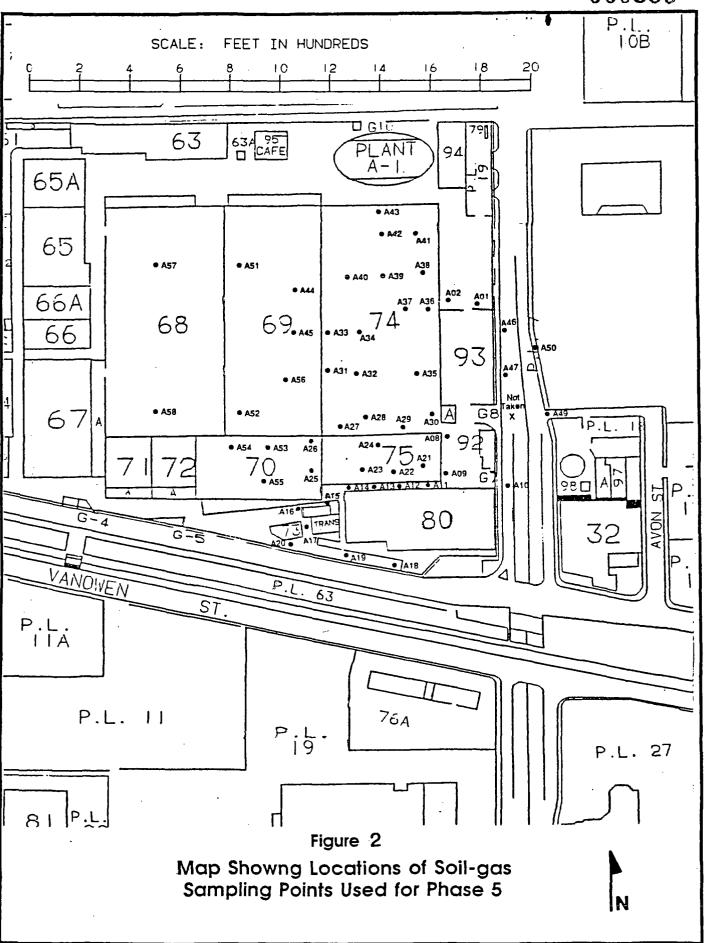
3.2 DISCUSSION OF PHASE 5 RESULTS

A summary of the soil-gas sampling results for the Phase 5 investigation is presented in Table 2. The GC/FID results indicated THC values below analytical detection limit of 1 ug/L except at one location (sampling point A31) where a THC value of 2 ug/L was recorded. Benzene and total xylenes were below the detection limits at all locations, while toluene was detected in the soil-gas from sampling point A31 at a concentration of 1 ug/L. The low concentration of toluene detected at this sampling point may indicate relatively minor contamination by hydrocarbon fuels or it may simply be indicative of surface usage of the solvent.

3.2.1 PCE Distribution

The highest concentrations of PCE (> 1000 ug/L), which was the major soil-gas contaminant, were recorded within the north and south walls of Building 75 at sampling points A22, A24 and A29 and at sampling point A52 in the southwest corner of Building 69 (see Figure 2). These two are probably related to the same soil contamination or point source within or adjacent to Building 75 and 69. It is possible that piping or underground lines located along the southern walls of Buildings 69 and 74 may be acting as conduits for gas-phase VOCs. Due to access constraints within building areas, soil-gas samples were not collected along the south wall of Building 68. Therefore, it is not possible to assess whether high PCE concentrations soil-gas may extend as far west as Building 67.

Relatively high concentrations of PCE (> 100 ug/L) were observed at 10 locations within the eastern wall of Building 74, suggesting that similar levels of soil contamination may be present along this north-south axis. PCE concentrations in the range of 1-100 ug/L west of Building 69, east of Building 93, and south of Buildings 70 and 75 probably reflect soil-gas diffusion from nearby source areas.



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TABLE 2. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FOR PHASE 5

Sample	Depth	Benze	======= ne Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
A01	4.0	< 0.04	< 0.05	< 0.05	< 0.04	22	108	340
A02	4.0	< 0.04	< 0.05	< 0.05	< 0.04	13	6	18
A08	3.5	<0.04	<0.04	<0.04	< 0.04	4	16	600
A09 A10	4.0 3.5	<0.04 <0.06	<0.04 <0.07	<0.04 <0.07	<0.04 <0.06	2 0.2	3 1	110 42
All	3.5	<0.04	<0.07	<0.07	<0.04	0.7	2	22
A12	2.0	< 0.04	<0.04	<0.04	<0.04	0.7	2	11
A13	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.2	2 5	84
A14	3.0	< 0.04	< 0.04	< 0.04	< 0.04	0.8	0.4	44
A15	3.5	< 0.04	< 0.04	< 0.04	< 0.04	0.4	2	8
A16	4.0	< 0.04	<0.04	< 0.04	< 0.04	0.1	1	10
A17	4.0	< 0.04	< 0.05	< 0.05	< 0.05	0.2	2	30
A18 A19	4.0 4.0	<0.04 <0.04	<0.05 <0.05	<0.05 <0.05	<0.04 <0.04	0.06	0.3	4 23
A20	2.0	<0.04	< 0.05	<0.05	<0.04	0.2 1	2 2	30
A21	3.0	<0.04	<0.03	<0.03	<0.04	6	36	380
A22	3.0	< 0.04	< 0.04	< 0.04	<0.04	Š	88	1000
A23	3.0	< 0.04	< 0.04	< 0.04	<0.04	50	24	930
A24	3.0	< 0.04	< 0.04	< 0.04	< 0.04	12	430	13000
A25	3.0	< 0.04	< 0.04	<0.04	< 0.04	47	19	630
A26	4.0	< 0.04	<0.04	<0.04	< 0.04	2	3	100
A27	4.0	< 0.04	<0.04	< 0.04	< 0.04	4	28	380
A28 A29	3.0 3.5	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	6 10	66 32	2200 1200
A30	4.0	<0.04	<0.04	<0.04	<0.04	20	28	640
A31	3.0	<0.04	1	<0.04	2	0.2	0.08	14
A32	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.4	0.9	380
A33	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.6	0.4	68
A34	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.3	0.2	41
A35	4.0	< 0.06	< 0.07	<0.05	< 0.06	4	10	220
A36	3.0	< 0.06	< 0.06	< 0.05	< 0.06	32	52	520
A37	3.0	< 0.06	< 0.06	< 0.05	< 0.06	160	25	340
A38	3.5	< 0.06	<0.06	< 0.05	< 0.06	0.6	4	11
A39 A40	3.0 3.0	<0.06 <0.06	<0.06 <0.06	<0.05 <0.05	<0.06 <0.06	36 46	33 72	250 420
A40 A41	3.0	< 0.06	<0.06	<0.05	< 0.06	18	190	380
A42	3.0	< 0.06	< 0.06	< 0.05	< 0.06	10	68	260
A43	3.0	< 0.06	< 0.06	< 0.05	< 0.06	0.9	78	77
A44	2.5	< 0.06	< 0.06	< 0.05	< 0.06	1	1	41
A45	3.0	< 0.06	< 0.06	< 0.05	< 0.06	0.2	0.4	12
A46	3.0	< 0.06	< 0.06	< 0.05	< 0.06	0.6	20	28

TABLE 2. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FOR PHASE 5

(continued)

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Sample No.	Depth (ft)		e Toluene (ug/L)	Tot. Xyl. (ug/L)	THC (ug/L)	TCA (ug/L)	TCE (ug/L)	PCE (ug/L)
A47 A49 A50	4.0 4.0 4.0	< 0.06	<0.07 <0.07 <0.07	<0.07 <0.07 <0.07	<0.06 <0.06 <0.06	0.6 0.2 0.2	8 3 6	84 55 26
A51 A52 A53	3.0 3.0 3.5	<0.06 <0.06	< 0.07	<0.07 <0.07 <0.07 <0.07	<0.06 <0.06 <0.06	0.2 0.9 4 0.6	2 1 3	86 1100 140
A45 A55 A56 A57	3.5 2.0 2.0 4.0	<0.06 <0.06		<0.07 <0.07 <0.07 <0.07	<0.06 <0.06 <0.06 <0.06	0.3 2 0.2 0.2	6 4 <0.007 0.1	140 36 4 2
A58 A17*	4.0 4.0	<0.06		<0.07 <0.07 <0.05	<0.06	0.2 0.2 0.3	0.1	1 15
A18 _* A19 _* A20 _* A26	4.0 4.0 4.0 4.0	<0.05 <0.05 <0.05 <0.05	< 0.05	<0.05 <0.05 <0.05 <0.05	15 36 2 2	2 0.09 0.4 0.05	140 630 8 2	280 300 56 34
AlMWI	_	\(\mathcal{O}\).03	# #	# #	# #	0.3	9 30	500 280
A1MW3	3 ⁺ 4.0	#	# #	# #	# #	60 0.1	22 0.008	602 0.5

Sampled during the Phase 6 soil-gas investigation Sampled during the Phase 1 soil-gas investigation All values below detection levels

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3.2.2 TCE Distribution

The distribution of high concentrations of TCE is similar to the distribution observed for PCE, although concentrations of TCE in soil-gas were less than those of PCE. Again, the highest TCE concentrations (430 ug/L at point 5A24) was present within the north wall of Building 75, while slightly lower levels were encountered along a north-south axis within the east walls of Buildings 74 and 75. TCE concentrations present in soil-gas to the east of Building 93, south of Building 75, and east of Building 74 suggest that the areal extent of contamination by TCE and PCE are similar. This similarity may be attributed to the following: (i) TCE is an impurity in technical grade PCE, (ii) solvent products often contain some mixture of TCE, PCE and TCA, and (iii) PCE can be biologically degraded to TCE.

3.2.3 TCA Distribution

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High concentrations of TCA in soil-gas (< 100 ug/L) were recorded at three locations (two within Building 75 and one in Building 74). Although the absolute concentrations of TCA were less than either TCE or PCE, the relative TCA levels among sampling locations suggest source areas and migration pathways which are similar to the other two solvents. These soil-gas data also suggest that areal extent of TCA-contaminated soil may be more limited than that of PCE- or TCE-contaminated soil. This is probably due to lower concentrations of TCA in the contaminated soil.

3.2.4 Potential Areas of Soil Contamination

The results of the soil-gas survey indicate that areas of soil contamination by PCE, and to a lesser extent, TCE and TCA, may exist beneath Building 74, 75 and 69, and that the VOC vapors may have migrated away from these areas in both the soil and soil-gas. PCE and TCE concentrations in excess of 100 ug/L (which were analyzed north of Building 74 during Phases 1 and 6) indicate the possibility of soil contamination extending as far as the northern end of Plant A-1. PCE-contaminated soil may be present as far west as Building 68 and as far south as Parking Lot 63.

The concrete foundation beneath Building 93 was too thick to penetrate with the coring tool. However, soil-gas samples collected from the perimeter of Building 93 were analyzed and used to estimate subsurface contamination in this area. Soil-gas data suggest that the major area of PCE contamination is located along the north wall of Building 75. Vapors or liquid contaminants may have migrated horizontally along a laterally-continuous barrier to vertical flow and/or diffusion. During the Phase 1 investigation, field personnel observed a barrier to probe penetration at a depth of approximately 14 feet to the east of Building 75. Low air permeabilities observed during soil-gas sampling may be indicative of a clay layer, which could result in the horizontal transport of VOCs. Shallow stratigraphic data are not available in this area; therefore, the presence and extent of such a clay layer cannot be confirmed.

3.2.5 Horizontal Concentration Gradients

Relatively steep horizontal concentration gradients are present in soil-gas near sampling point A24 in Building 75. Steep concentration gradients are commonly observed when sampling in or adjacent to contaminated soil. The limited data

collected near location A52 in Building 69 also indicates a steep horizontal gradient and VOC concentrations which are characteristic of soil contamination. PCE concentrations in the 1-100 ug/L range at distances greater than 200 feet from the potentially contaminated soil, probably reflect PCE diffusion in soil-gas.

3.2.6 **Quality Assurance**

See Section 2.2.4.

3.3 PHASE 5 CONCLUSIONS

Based on the results of the Phase 5 soil-gas investigation and on the objectives for evaluating subsurface contamination, the conclusions and recommendations listed below are provided. The conclusions and recommendations have been or will be implemented in subsequent phases of the soil-gas survey and in other tasks associated with LASC's comprehensive site assessment and remediation program.

- o The Phase 5 soil-gas survey has provided a cost-effective, quick method for identifying suspect soil contamination areas within the areas surveyed. The results confirm that soil-gas surveying is applicable to locating previously unknown areas of contamination at the LASC site, as well as to mapping areas of known soil contamination.
- o Based on the results of soil-gas sampling and analysis, soil contamination probably exists beneath Buildings 75 and 69. Other areas containing elevated soil-gas concentrations may be due to either vapor-phase transport or horizontal liquid transport along a possible clay layer at a depth of approximately 14 feet.
- o Soil borings should be installed and sampled in Buildings 75 and 69 in order to evaluate shallow stratigraphy and to delineate the vertical extent of soil contamination.
- o The soil-gas data suggest that the horizontal and vertical transport of liquids and vapors may be controlled by the site-specific stratigraphy and underlying clay lenses.

SECTION 4

PHASE 6 INVESTIGATION

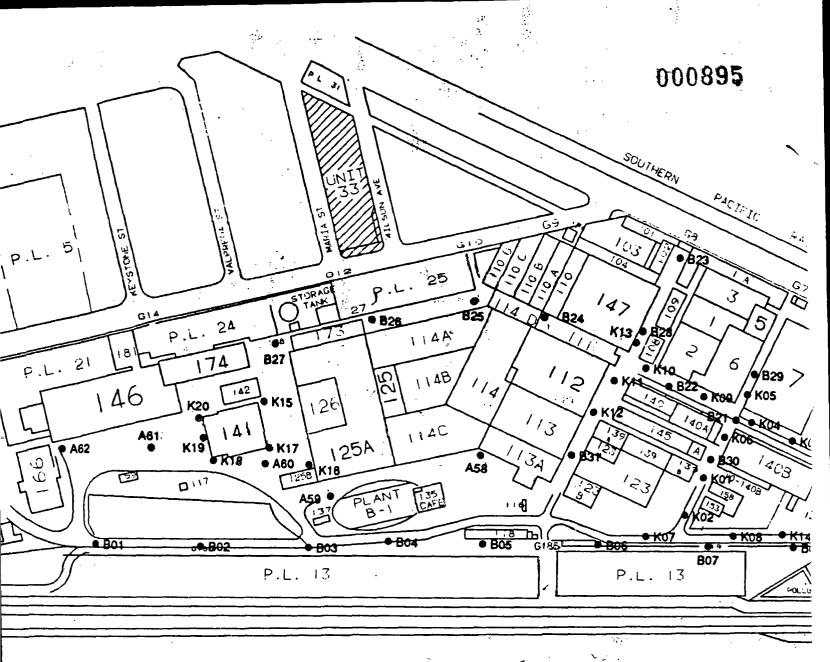
4.1 OBJECTIVES OF PHASE 6

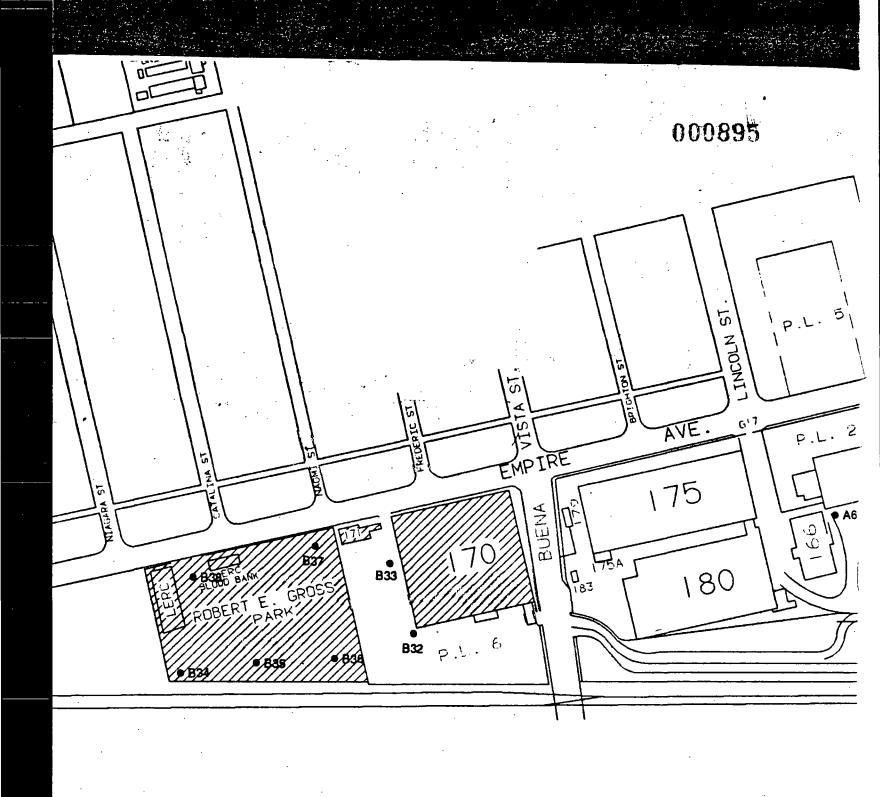
The major objective of the Phase 6 study was to identify areas of potential soil contamination in the vicinity of Plants B-1, B-6, and A-1 within those areas of the LASC facility not covered in other phases of the survey. This phase of the survey work was specifically designed to identify any previously unidentified areas with high concentrations of chlorinated solvents or volatile hydrocarbons in the soil-gas. Secondary objectives for this phase included the identification of areas where VOC concentrations in soil-gas were probably not influenced by surface sources and the assessment of chlorinated solvent concentrations in ambient air at various locations around the LASC facility.

During the Phase 6 investigation, soil-gas was collected and analyzed from a total of 78 locations within Plant B-1, 62 locations within Plant A-1, and 62 locations within Plant B-6 (see Figures 3, 4, and 5 for sampling locations). Although sampling transects were established prior to soil-gas sampling, the exact location and number of points within the various areas were based, in part, on real-time results produced during the survey. The average spacing between sampling points during this phase was 250 to 400 feet, which is appropriate (according to the results of the Phase 2 investigation) for indicating potential source areas but which exceeds the probe spacing used to estimate either source boundaries or probable migration pathways.

4.2 DISCUSSION OF PHASE 6 RESULTS

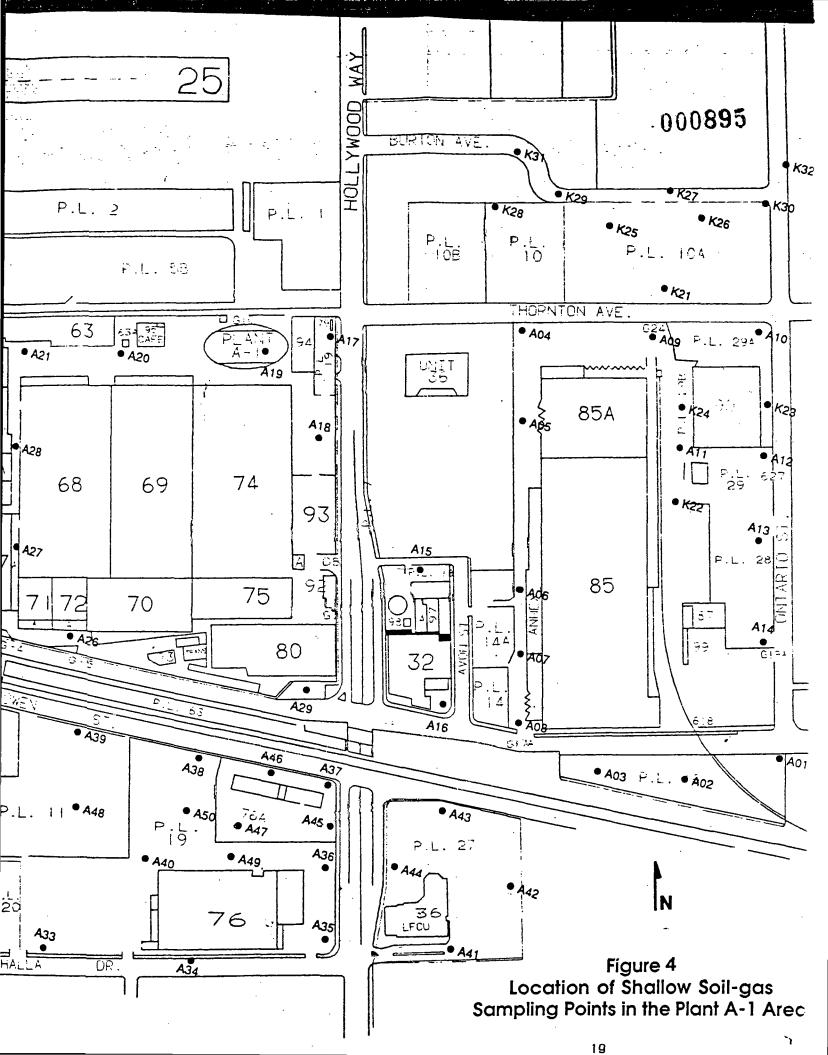
A summary of the soil-gas sampling results for the Phase 6 investigation are presented in Tables 3, 4 and 5 for Plants B-1, A-1, and B-6, respectively. The GC/FID results do not indicate any volatile hydrocarbons present above the analytical detection limit of 1 ug/L except at 6 points. Four of these points (i.e., B11, B12, C01 and K06) are located in the southeast portion of the Plant B-1, while the remaining two points (i.e., A07 and A22) are located within the Plant A-1 area. A review of the chromatograms from the analysis of soil-gas samples from these six points suggests that hydrocarbon concentrations, ranging from 13 to 1600 ug/L, were probably a result of compounds other than chlorinated solvents (e.g., petroleum hydrocarbons or oxygenated solvents). At locations B11 and B12, benzene was present, indicating that the GC/FID signal could be the result of fuel contamination (petroleum hydrocarbons).

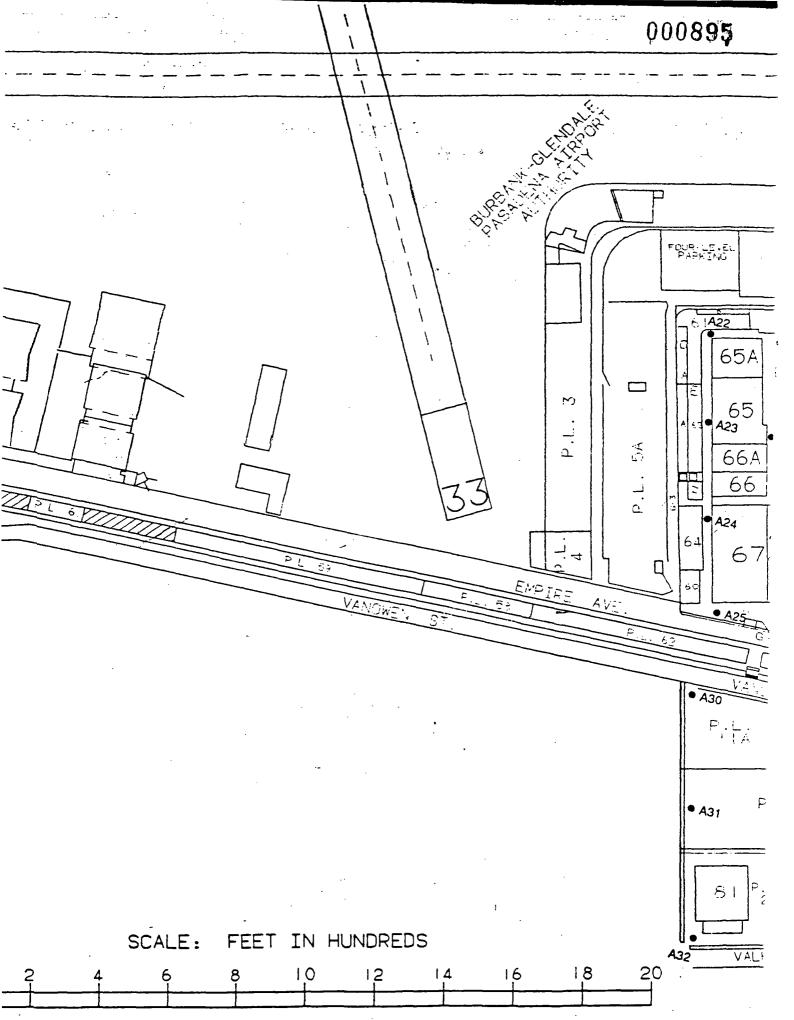


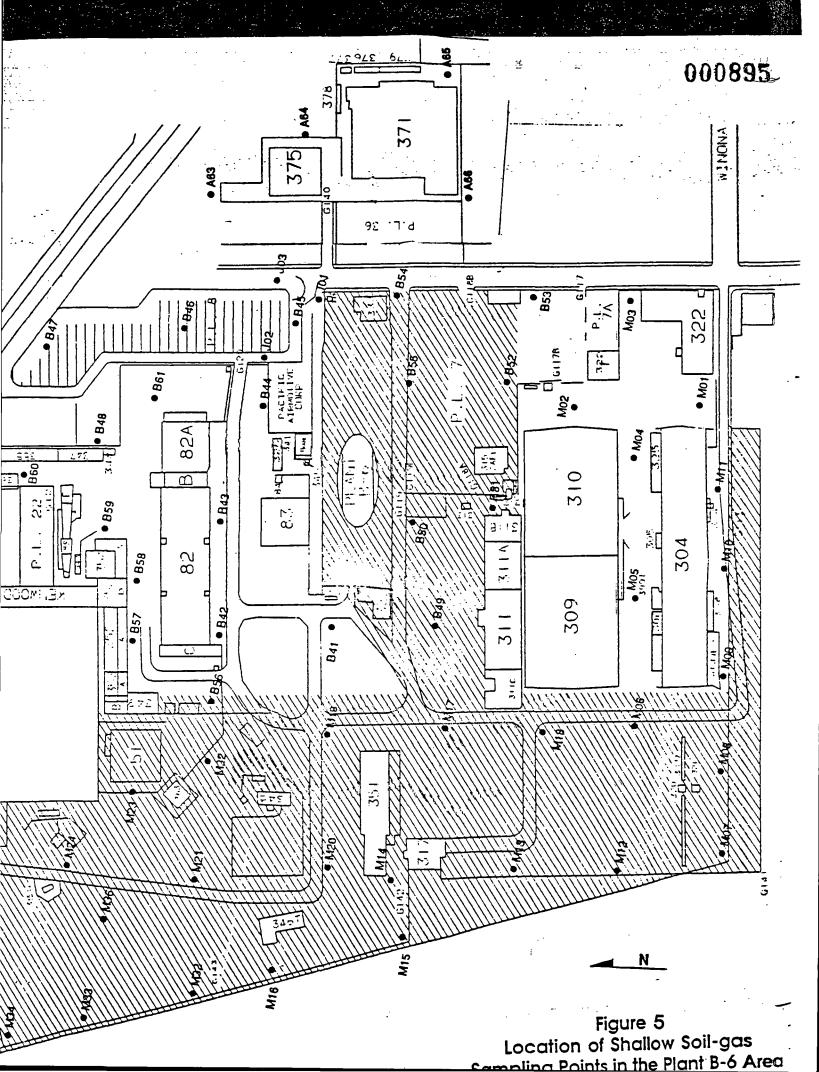


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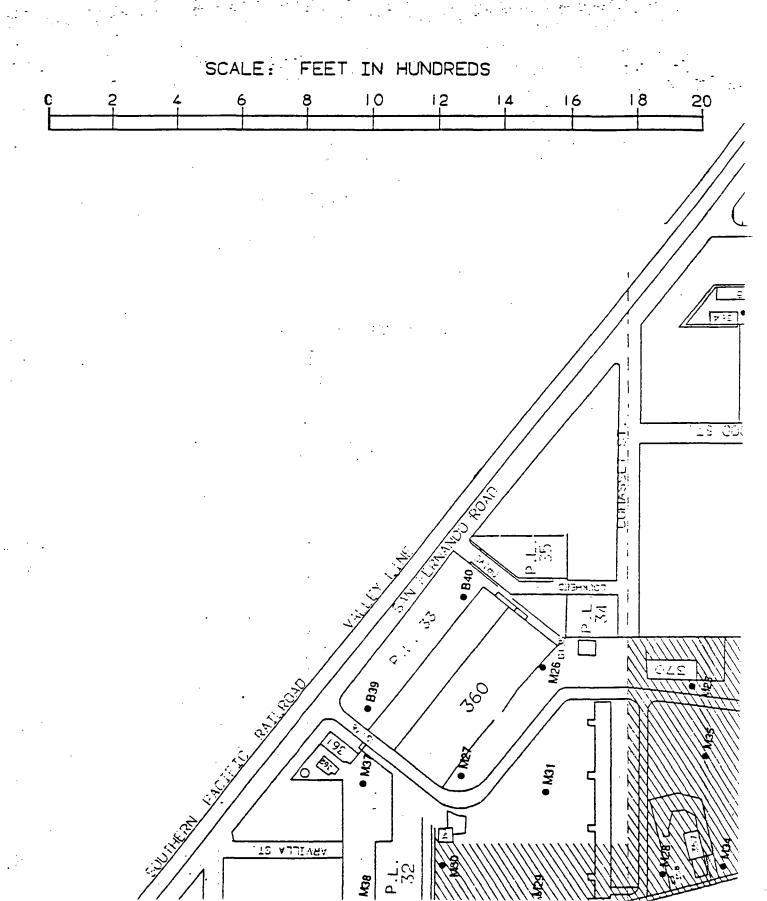


TABLE 3. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT B-1 FOR PHASE 6

=====	=====:	=====	======	======	======	=======		
Sample No.	Depth (ft)	Benzer (ug/L)	ne Toluene (ug/L)	Tot. Xyl. (ug/L)	THC (ug/L)	TCA (ug/L)	TCE (ug/L)	PCE (ug/L)
A51	4.0	< 0.05	<0.06	<0.05	<0.2	0.2	< 0.001	0.03
A52	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.02	< 0.004	< 0.05
A53	4.0	< 0.03	< 0.04	< 0.03	0.1	0.03	< 0.0007	0.01
A54	4.0	< 0.03	< 0.04	< 0.03	1	0.01	2	0.3
A55	4.0	< 0.03	< 0.04	· < 0.03	< 0.03	0.3	5	0.3
A56	4.0	< 0.03	< 0.04	< 0.03	0.4	0.4	< 0.003	0.02
A57	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.007	0.01	0.02
A58	4.0	< 0.04	< 0.05	< 0.05	<0.04	0.02	0.3	0.2
A59	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.03	0.4	0.08
A60	4.0	< 0.04	<0.05	< 0.05	< 0.04	0.08	58	10
A61	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.3	8	1
A62	3.0	< 0.04	<0.05	< 0.05	<0.04	2	1	2 4
A63	4.0	< 0.07	<0.08	<0.08	N/A	0.04	0.6	65
A64 A65	4.0 4.0	<0.04 0.6	<0.04 <0.04	<0.04 <0.04	N/A	1 14	0.6 8	350
A66	4.0	<0.04	<0.04	<0.04	N/A N/A	0.1	0.5	2
AUU	4.0	<0.04	<0.04	<0.04	11/74	0.1	0.5	2
B 01	4.0	< 0.2	< 0.3	< 0.3	< 0.2	0.03	0.007	0.08
B02	4.0	< 0.24	< 0.3	< 0.3	< 0.24	0.02	0.75	0.2
B03	4.0	< 0.5	< 0.5	<0.6	< 0.5	0.1	23	0.6
B04	4.0	<2.4	<2.7	<2.9	<2.4	0.3	6	0.3
B05	4.0	< 0.2	< 0.3	<0.3	<0.2	0.006	1	0.05
B05	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.003	0.2	0.01
B06	4.0	< 0.2	< 0.3	< 0.3	<0.2	0.03	0.1	0.3
B07	4.0	<0.2	<0.3	< 0.3	<0.2	7	15	4400
B08	4.0	<5	<5	<6	<5	0.2	0.03	24
B09	4.0	<0.2	<0.3	<0.3	<0.2	0.02	0.04	0.02
B10	4.0	<2	<3	<3	<2	0.3	0.1	0.3
B11	4.0	28	0.6	<0.6	323	0.06	2	0.2
B12	4.0	32	<0.5	<0.5	151	0.0006	0.04	0.02 0.02
B13	2.0	6	<0.05	<0.06	10	0.02 0.03	0.1	
B14 B15	2.0 4.0	<0.2 <0.2	<0.3 <0.2	<0.3 <0.2	<0.2 <0.2	0.03	0.02 0.3	0.06 0.2
B15	4.0 1.5	<0.2	<0.2	<0.2 <0.3	<0.2	0.4	0.04	0.2
B17	4.0	<0.2	<0.3	<0.2	< 0.2	0.4	0.001	0.03
B18	4.0	<0.2	<0.2	<0.2	<0.2	0.2	0.061	0.08
B19	4.0	<0.2	<0.2	<0.2	<0.2	0.2	0.2	0.1
B20	4.0	<0.2	<0.2	<0.2	<0.2	0.07	0.1	0.8
B21	4.0	<0.2	<0.2	<0.2	<0.2	0.5	0.8	12000
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TABLE 3. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT B-1 FOR PHASE 6

(continued)

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C1.	Domah	D	Та1	T. V.1	THE	TOA	TOD	DCD
			ne Toluene			TCA	TCE	PCE
No.	(ft)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
						~~~~~~		
B22	1.5	<5	<5	<4	<5	0.9	1800	1000
B23	3.0	< 0.2	< 0.2	< 0.2	<0	0.1	0.007	0.07
<b>B24</b>	4.0	<5	<5	. <4	<5	0.2	2	3300
B25	4.0	< 0.6	< 0.6	< 0.5	< 0.5	0.1	4	24000
<b>B26</b>	4.0	< 0.5	< 0.5	< 0.5	< 0.5	0.4	0.4	3
B27	4.0	<0.4	< 0.59	< 0.4	< 0.4	0.06	0.7	7
B28	4.0	<11	<12	<10	<11	0.2	4	140
B29	4.0	< 0.2	< 0.2	< 0.2	< 0.2	0.02	0.001	0.25
<b>B</b> 30	4.0	<2	<2	<2	<2	4	12	910
B31	4.0	<2	<2	<2	<2	0.4	8	3
<b>B32</b>	4.0	< 0.04	< 0.04	< 0.04	< 0.04	5	3	0.5
<b>B33</b>	4.0	<6	<6	<5	<6	0.3	< 0.03	44
B34	4.0	< 0.6	<0.6	< 0.5	<0.6	2	< 0.003	0.3
B35	4.0	< 0.6	< 0.6	< 0.5	<0.6	1	< 0.003	< 0.05
B36	4.0	< 0.2	< 0.2	<0.2	<0.2	0.05	< 0.001	0.04
B37	4.0	< 0.2	< 0.2	<0.2	< 0.2	0.02	< 0.001	0.08
B38	4.0	< 0.5	< 0.5	< 0.4	< 0.5	0.02	< 0.003	< 0.02
C01	4.0	< 0.6	<0.6	<0.6	100	0.1	2	4
C02	6.5	<0.6	<0.6	<0.6	<0.6	0.03	0.1	6
C03	4.0	<0.6	<0.6	<0.6	<0.6	0.03	0.4	10
C04	4.0	<0.6	<0.6	<0.6	<0.6	0.03	2	4
C05	4.0	< 0.6	<0.6	<0.6	<0.6	0.02	1	0.4
C06	4.0	<0.6	<0.6	<0.6	<0.6	0.02	0.8	0.2
C07	4.0	<0.6	<0.6	<0.6	<0.6	< 0.002	0.5	0.06
C08	4.0	<0.6	<0.6	<0.6	<0.6	0.03	22	0.9
C09	4.0	<0.6	<0.6	<0.6	<0.6	0.04	10	1
K01	4.0	<0.06	<0.07	<0.07	<0.06	24	52	2200
K02	4.0	<0.06	<0.07	<0.07	< 0.06	8	17	1100
K03	4.0	< 0.06	<0.07	< 0.07	< 0.06	0. <b>4</b>	< 0.003	0.3
K04	4.0	< 0.06	<0.07	< 0.07	<0.06	0.6	<0.003	3
K05	4.0	<0.06	<0.07	<0.07	< 0.06	0.0	0.04	0.4
K06	3.0	<0.06	<0.07	<0.07	1600	200	<0.7	700
K07	4.0	< 0.06	<0.07	<0.07	< 0.06	0.2	0.6	<b>29</b>
K08	4.0	< 0.06	<0.07	< 0.07	< 0.06	1	1	260
K09	4.0	< 0.06	<0.07	< 0.07	< 0.06	2	10	86
<b>-</b>			<i>•</i>		-5100	_	20	-

TABLE 3. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT B-1 FOR PHASE 6

(continued)

Sample	Depth		e Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
K10	3.0	<0.06	<0.07	<0.07	<0.06	<0.03	360	150
K11	4.0	<0.06	<0.07	<0.07	<0.06	<0.3	660	740
K12	3.5	<0.07	<0.07	<0.08	<0.07	2	1000	1200
K13	4.0	<0.07	<0.07	<0.08	<0.07	0.08	32	35
K14	3.5	<0.07	<0.07	<0.08	<0.07	2	<0.07	280
K15	4.0	<0.07	<0.07	<0.08	<0.07	2	6	6
K16	3.5	<0.07	<0.07	<0.08	<0.07	0.09	28	2
K17	4.0	<0.07	<0.07	<0.08	<0.07	0.1	32	6
K18	2.5	<0.07	<0.07	<0.08	<0.07	0.04	1	0.2
K19	2.5	<0.07	<0.07	<0.08	<0.07	0.06	2	0.4
K20	4.0	<0.07	<0.07	<0.08	<0.07	0.4	3	0.9

TABLE 4. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT A-1 FOR PHASE 6

Sample No.	Depth (ft)	Benzer (ug/L)	ne Toluene (ug/L)	Tot. Xyl. (ug/L)	THC (ug/L)	TCA (ug/L)	TCE (ug/L)	PCE (ug/L)
<b>A</b> 01	4.0	<0.04	<0.05	<0.05	< 0.04	0.08	<0.0006	0.2
A02	4.0	< 0.3	<0.3	<0.3	< 0.3	0.06	< 0.002	0.5
A03	4.0	< 0.3	< 0.3	< 0.3	< 0.3	0.04	0.1	1
A03	4.0	< 0.3	< 0.3	< 0.3	< 0.3	0.05	<0.001	0.1
A04	4.0	< 0.2	< 0.2	·<0.2	< 0.2	0.02	< 0.001	0.09
A05	2.0	< 0.5	<0.5	< 0.4	< 0.5	0.01	0.3	0.2
A06	4.0	<0.5	< 0.5	< 0.50	< 0.5	0.01	0.7	0.06
A07	1.0	< 0.5	< 0.5	< 0.4	13	0.1	0.005	0.05
A08	3.5	<0.3	< 0.3	<0.3	<0.3	0.01	0.3	0.4
A09	3.5	<3	<3	<3	<3	0.008	24	<b>79</b>
A10	4.0	< 0.07	< 0.07	< 0.06	< 0.07	0.07	2	16
All	4.0	< 0.05	< 0.05	< 0.05	< 0.3	0.01	16	31
A12	4.0	< 0.05	< 0.05	< 0.05	0.1	0.2	0.006	0.2
A13	4.0	< 0.05	< 0.05	< 0.05	0.8	2	< 0.002	0.07
A14	4.0	< 0.05	< 0.05	< 0.05	0.6	2	0.3	0.5
A15	4.0	< 0.4	<0.4	<0.4	<0.4	0.07	14	90
A16	4.0	< 0.1	< 0.2	< 0.1	0.1	0.02	0.05	0.2
A17	4.0	< 0.05	< 0.05	< 0.05	< 0.05	0.3	30	15
A18	4.0	< 0.05	< 0.05	< 0.05	< 0.2	2	140	280
A19	4.0	< 0.05	< 0.05	< 0.05	< 0.6	0.09	630	300
A20	4.0	< 0.05	< 0.05	< 0.05	< 0.2	0.4	8	56
A21	4.0	< 0.05	< 0.05	< 0.05	< 0.05	0.03	0.2	0.6
A22	4.0	<0.1	<0.1	<0.1	750	0.002	0.02	0.05
A23	4.0	<0.1	<0.1	<0.1	< 0.1	0.03	1	11
A24	4.0	< 0.05	<0.05	< 0.05	0.1	0.05	0.03	0.2
A25	4.0	< 0.05	<0.05	< 0.05	< 0.05	0.03	0.1	0.4
A26	4.0	< 0.05	< 0.05	< 0.05	<0.2	0.05	2	34
A27	4.0	< 0.05	< 0.05	< 0.05	< 0.05	0.03	0.02	0.1
A28	4.0	< 0.05	< 0.05	< 0.05	< 0.05	0.06	0.03	0.2
A29	3.5	< 0.05	< 0.06	< 0.06	0.1	0.1	0.3	22
A30	4.0	< 0.04	< 0.04	<0.04	< 0.04	0.05	<0.902	0.07
A31	4.0	< 0.04		< 0.04	< 0.04	0.03	<0.001	0.02
A32	4.0	< 0.05	< 0.06	<0.06	< 0.05	0.4	< 0.002	0.02
A33	4.0	< 0.05	<0.06	<0.06	< 0.05	0.03	< 0.002	0.01
A34	3.0	< 0.05	< 0.06	<0.06	< 0.05	0.07	0.05	0.02
A35	2.5	< 0.05	< 0.06	< 0.06	< 0.05	0.04	< 0.002	2
A36	4.0	<0.04	< 0.04	<0.04	< 0.04	0.03	0.4	16
A37	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.1	0.2	130

TABLE 4. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT A-1 FOR PHASE 6

(continued)

Sample	Depth		e Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
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A38	4.0	< 0.05	< 0.06	< 0.06	5	0.1	0.01	0.4
A39	4.0	< 0.05	< 0.06	< 0.06	< 0.05	0.08	5	45
A40	4.0	< 0.05	< 0.06	<0.06	< 0.05	0.1	0.004	0.4
A41	3.5	< 0.05	< 0.06	< 0.06	< 0.05	0.02	0.1	0.8
A42	3.5	< 0.05	< 0.06	< 0.06	< 0.05	0.2	1	0.6
A43	4.0	< 0.04	< 0.05	< 0.05	< 0.05	0.02	0.4	0.9
A44	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.03	0.5	3
A45	4.0	< 0.05	< 0.06	< 0.05	< 0.05	0.05	2	420
A46	4.0	< 0.05	< 0.06	< 0.05	< 0.05	0.02	0.2	20
A47	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.03	0.7	10
A48	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.01	< 0.001	0.003
A49	2.0	< 0.03	< 0.04	< 0.03	< 0.03	0.04	0.1	1
A50	4.0	20.03	<0.04	< 0.03	< 0.03	0.03	0.03	1
K21	4.0	< 0.07	< 0.07	<0.08	< 0.07	0.6	100	180
K22	2.0	< 0.07	< 0.07	< 0.08	< 0.07	2	20	10
K23	4.0	< 0.07	< 0.07	< 0.08	< 0.07	3	< 0.007	0.2
K24	4.0	< 0.07	< 0.07	< 0.08	< 0.07	< 0.03	47	240
K25	4.0	< 0.07	< 0.07	< 0.08	< 0.07	1	140	44
K26	4.0	< 0.07	< 0.07	<0.08	< 0.07	2	120	22
K27	4.0	< 0.07	< 0.07	<0.08	< 0.07	5	140	23
K28	4.0	< 0.07	< 0.07	80.0>	< 0.07	< 0.003	7	2
K29	4.0	< 0.07	< 0.07	< 0.08	< 0.07	4	200	56
K30	4.0	< 0.07	< 0.07	< 0.08	< 0.07	2	28	3
K31	4.0	< 0.07	< 0.07	< 0.08	< 0.07	< 0.003	48	14
K32	4.0	< 0.07	< 0.07	<0.08	< 0.07	19	8	2

N/A = Not Analyzed

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TABLE 5. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT B-6 FOR PHASE 6

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Sample	Depth	Benzer	ne Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
M01	4.0	< 0.03	< 0.04	< 0.03	< 0.03	0.009	< 0.001	0.03
M02	4.0	0.3	< 0.04	< 0.03	0.5	< 0.007	< 0.001	2
M03	4.0	< 0.03	< 0.04	< 0.03	< 0.03	< 0.05	<0.001	0.1
M05	4.0	< 0.2	< 0.3	<0.3	< 0.2	0.006	1	0.05
M06	4.0	< 0.03	< 0.04	< 0.03	< 0.03	< 0.007	4	0.02
M07	1.5	< 0.04	< 0.04	< 0.04	< 0.04	0.09	< 0.004	0.05
M09	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
M09	2.0	< 0.04	< 0.04	< 0.04	< 0.04	0.1	< 0.002	0.06
M10	2.0	< 0.04	< 0.04	< 0.04	< 0.04	0.1	< 0.004	0.06
M11	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.2	< 0.004	0.06
M12	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.2	< 0.0004	
M13	3.5	< 0.04	< 0.04	< 0.04	< 0.04	< 0.0002	< 0.0004	
M14	4.0	< 0.04	<0.04	< 0.04	< 0.04	< 0.0002	< 0.0004	
M15	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.04	< 0.0004	0.01
M16	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.02	< 0.0004	
M17	4.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.002	5	0.04
M18	4.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.001	1	0.02
M19	3.5	< 0.04	<0.04	< 0.04	< 0.04	0.04	< 0.0004	
M20	4.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.002	< 0.004	0.003
M21	4.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.0005	< 0.001	0.006
M22	4.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.001	< 0.002	0.04
M23	4.0	< 0.04	< 0.04	< 0.04	<0.04	< 0.002	< 0.004	0.4
M24	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.3	0.1	0.06
M25	4.0	< 0.04	< 0.05	< 0.05	< 0.04	5	< 0.006	2
M26	4.0	<0.5	<0.5	<0.4	<0	0.4	0.4	3
M28	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.04	<0.0006	
M29	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.01	<0.0006	
M30	4.0	< 0.04	< 0.05	<0.05	< 0.04	0.07	0.3	0.04
M31	4.0	<2	<2	<2	<2	0.4	8	3
M32	4.0	< 0.04	< 0.04	< 0.04	<0.04	0.01	< 0.0004	
M33	4.0	<6	<6	<5	<6	0.3	< 0.03	44
M34	4.0	<0.6	<0.6	<0.5	< 0.6	2	< 0.003	0.3
M35	4.0	<0.6	<0.6	<0.5	< 0.6	1	< 0.003	6.04
M36	4.0	<0.2	<0.2	< 0.2	<0.2	0.05	< 0.001	0.04
M37	4.0	<0.2	<0.2	<0.2	<0.2	0.02	< 0.001	0.08
M38	4.0	<0.5	< 0.5	<0.4	< 0.5	0.02	< 0.003	< 0.02

N/A = Not Analyzed

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TABLE 5. RESULTS OF ANALYSIS OF SOIL-GAS SAMPLES FROM PLANT B-6 FOR PHASE 6

(continued)

Sample	Depth	Benzer	e Toluene	Tot. Xyl.	THC	TCA	TCE	PCE
No.	(ft)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
B39	2.0	< 0.04	< 0.04	< 0.04	< 0.04	0.06	0.6	0.3
<b>B</b> 40	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.04	0.3	0.2
B41	4.0	< 0.04	< 0.04	< 0.04	< 0.04	<b>&lt;0</b> .001	2	0.02
B43	3.0	< 0.04	< 0.04	< 0.04	< 0.04	1	< 0.003	
<b>B</b> 44	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.06	< 0.003	0.7
B45	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.2	7	53
<b>B</b> 46	4.0	< 0.04	< 0.05	< 0.05	< 0.04	3	1	2
B47	4.0	< 0.04	< 0.05	< 0.05	< 0.04	14	< 0.006	0.4
<b>B</b> 48	4.0	< 0.04	< 0.05	< 0.05	< 0.04	110	< 0.006	3
B49	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.9	24	0.1
<b>B</b> 50	4.0	< 0.04	< 0.05	< 0.05	< 0.04	< 0.003	13	0.08
B51	4.0	< 0.04	< 0.05	< 0.05	< 0.04	< 0.003	5	0.04
<b>B53</b>	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.5	0.1	1
B54	4.0	< 0.04	< 0.05	< 0.05	< 0.04	0.6	3	10
B55	4.0	< 0.04	< 0.05	< 0.05	< 0.04	< 0.002	0.3	0.3
<b>B</b> 56	3.0	< 0.04	< 0.04	< 0.04	<0. <b>0</b> 4	9	0.6	1
B57	3.0	< 0.04	< 0.04	< 0.04	< 0.04	160	< 0.005	16
B58	4.0	< 0.04	< 0.04	< 0.04	< 0.04	2	0.1	0.8
B59	4.0	< 0.04	< 0.04	< 0.04	< 0.04	0.2	< 0.0005	< 0.09
<b>B</b> 60	4.0	< 0.04	< 0.04	< 0.04	< 0.04	<b>28</b> .	< 0.005	0.8

N/A = Not Analyzed

# 4.2.1 Plant B-1 Area

Discussion of Plant B-1 will exclude the area located adjacent to Buildings 175 and 180, which has been covered in detail as part of the Phase 2 report. Data collected during the Phase 1 investigation indicated that, in addition to the known contaminant source associated with the former clarifier near Building 175, there may be other sources located in the central and eastern sections of Plant B-1 which were influencing VOC concentrations in soil-gas. As a result of those observations, a source identification survey was conducted within Plant B-1 as part of the Phase 6 field study.

The major compound detected in soil-gas samples in the vicinity of Plant B-1 was PCE. Maximum PCE concentrations observed were approximately 2 orders of magnitude greater than the maximum TCE concentrations and 3 orders of magnitude, higher than the highest TCA concentrations. TCE concentrations indicative of soil contamination (> 100) were detected at only 5 sampling points, while no TCA concentrations were indicative of soil contamination.

### PCE Distribution --

In addition to the former clarifier near Building 175, there appears to be two other areas of possible PCE soil contamination within the boundaries of Plant B-1. The first is associated with Buildings 123 and 139 (extending as far east as the area south of Building 140B), where PCE concentrations at sampling points B07, K01, K02 and K12 exceeded 1,000 ug/L. A second potential source is located near the northeast corner of Building 114A, where the highest PCE concentration within the Plant B-1 area (24,000 ug/L) was measured at sampling point B25.

There were three additional points at which PCE concentrations in soil-gas exceeded 1,000 ug/L. Point B24 is located west of B25 in Building 111, while points B21 and B22 are located north of Buildings 140B and 140, respectively. These three relatively high soil-gas readings are surrounded by sampling points at which PCE concentrations were as much as 5 orders-of-magnitude lower. Similar distributions of VOC concentrations in soil-gas are frequently observed either near conduits carrying solvents (e.g., feed pipes) or along very permeable zones such as utility backfill or building foundations. The hypothesis that PCE may have migrated in this gaseous or aqueous phase, southeasterly along a permeable zone, is further supported by field observations of cement and/or gravel which prevented probes from being driven to the 4-foot depth at sampling point B22.

PCE concentrations in soil-gas surrounding the potential source near Buildings 123 and 139 exhibit a spatial distribution (i.e., relatively gradual decreases in concentration as a function of radial distance from the most contaminated points). This suggests that PCE has migrated from a point source (similar to the distribution observed near Building 175). The apparent radial spreading of PCE from the potential source near Buildings 123 and 139 may have resulted from contaminant migration in the soil, soil-gas, or a combination of both. Soil sampling and analysis would be needed to distinguish between contaminant migration in soil and soil-gas.

PCE concentrations of 35 and 44 ug/L were analyzed at points B32 and B33 located to the west and southwest of Building 170 (west side of Buena Vista Street). PCE contamination in soil-gas at these two points may be related to a small localized

source near Building 170 or to gas-phase migration from the source areas near Buildings 175 and 180. An anomalously high PCE concentration of 310 ug/L was noted at point C11 (located near the west side of Buena Vista Street) during the Phase 2 study. The presence of PCE at C11, as well as at B32 and B33, may be due to westward vapor migration along subsurface conduits which run under Buena Vista Street. Five soil-gas points were sampled in the Robert E. Gross Park (located just west of Building 170). PCE concentrations were below 1.0 ug/L at all points within the Park, further suggesting that the contaminant source is located either beneath or east of Building 170.

PCE concentrations in the 1-10 ug/L range were recorded from four sampling points which were clustered west of Building 125A and from five points located west of Building 126. These concentrations are indicative of PCE migration in soil-gas from a distant contaminated area. Low-level soil-gas contamination in the former area may have resulted from gaseous diffusion from the PCE source near Building 114A, while PCE in soil-gas from the latter area may be related to the nearby pond or former landfill. Sections of Plant B-1, other than those which have been discussed, contained PCE concentrations less than 1 ug/L, suggesting that these sections are probably not situated near potential sources.

#### TCE and TCA Distribution --

TCE concentrations observed in soil-gas samples were lower than the observed PCE concentrations. At only 5 sampling points were TCE concentrations over 100 ug/L. The lower concentrations of TCE observed could be due to the curtailment of usage some years ago, the presence of TCE as an impurity in technical-grade PCE, the tendency for PCE to undergo anaerobic dechlorination to TCE, or a combination of these.

The locations which had high TCE concentrations corresponded to those with elevated PCE concentrations. TCE concentrations in soil-gas over 100 ug/L were observed within Buildings 123 and 139, north of Buildings 140 and 140B, and north of Building 114.

TCE concentrations above the 1 ug/L level were also encountered (i) along the eastern section of Parking Lot 13, (ii) northeast of Building 199, (iii) adjacent to Building 141, and (iv) south of Building 149. TCE concentrations above 100 ug/L were measured in samples collected from points B22, K!! and K12, located to the west-southwest of Building 140; these results may indicate nearby soil contamination. In general, soil-gas samples contained lower TCA concentrations than PCE or TCE concentrations. Considering the TCA concentrations and horizontal gradients, the likely source of the TCA detected was vapor-phase transport from locations where TCA is used.

TCA concentrations also exceeded the 1 ug/L level at locations which have been identified as potential sources of PCE. The highest TCA concentration within the Plant was analyzed from a soil-gas sample collected at sampling point K06 west of Building 140B. Apparent similarities between the distribution of TCA and PCE may be explained by mechanisms similar to those identified for TCE and PCE. In addition, TCA possesses the highest diffusion coefficient of the three chlorinated solvents.

# Other Volatile Compounds --

In addition to the presence of chlorinated solvents within the Plant B-1 areas, it appears from GC/FID chromatograms that VOC contamination may be present in areas surrounding Building 126 and east of Building 140A. THC concentrations ranged from 100 to 320 ug/L at three soil-gas points (i.e., C01, B11, and B12) near Building 621, while THC was detected at 1600 ug/L at point K06. It is likely that these THC concentrations are indicative of petroleum hydrocarbons or oxygenated compounds (e.g., ketones, alcohols), both of which are detected by the GC/FID method. Benzene was detected in soil-gas samples from B11 and B12 at concentrations of 28 and 32 ug/L, respectively, possibly indicating the presence of hydrocarbon fuels. Toluene and total xylenes were not present above detection limits at any of the sampling points.

## 4.2.2 Plant A-1 Area

The results of the Phase 1 soil-gas investigation suggested that there may be sources of chlorinated solvents within the Plant A-1 area (particularly in the vicinity of Building 93). On the basis of those results, delineation of PCE contamination within Building 93 was performed in Phase 5 of the soil-gas survey. In an effort to identify other potential sources within Plant A-1, the Phase 6 study focused on areas other than within Building 93.

#### **PCE Distribution --**

The Phase 6 soil-gas survey data indicate that, in addition to the vicinity of Building 93, there may be as many as two potential areas of elevated PCE concentrations within Plant A-1. One such area of possible soil contamination is located within Building 76A on the south side of Vanowen Street. The soil-gas data suggest the presence PCE contamination in this area may be the result of a local source rather than gas phase migration of PCE across the street from the Building 93 area. If the soil-gas contamination at Building 76A is a result of the Building 93 source, then PCE has probably contaminated a soil layer beneath the site. It is unlikely, based on the observation of relatively steep gradients near point sources, that PCE diffusion in soil-gas from Building 93 could account for concentrations as high as 420 ug/L at point A45 on the south side of Vanowen Street.

The second area of PCE contamination appears to be somewhere north of Building 85A as indicated by soil-gas concentrations as high as 240 ug/L at K24. PCE concentrations in the tens of ug/L were present as far north as Burton Avenue and as far east as Ontario Street, suggesting that there has been considerable gas-phase diffusion of PCE from sources located near Buildings 85A and 90 or north of Thornton Avenue.

The extent of migration of PCE either as a liquid in the soil or as a gas in the soil-gas is not clear because there are several sampling locations at which soil-gas concentrations are anomalously low (i.e., substantially lower than at surrounding points). Samples were collected either beneath bare soil or at depths of 2 feet or less from A05, A07, A16, A17, A19 and A38. Thus, the degree to which the observed elevated readings in soil-gas are actually a result of different sources is difficult to assess. The Phase 5 investigation (described in Section 3) was designed to estimate the boundaries of source areas and to assess horizontal concentration gradients within Plant A-1.

### TCE and TCA Distribution --

The data suggest that TCE and PCE have similar sources within Plant A-1. TCE soil contamination probably exists near the northeast corner of Building 74 where soil-gas concentrations of 140 and 630 ug/L were measured at points A18 and A19, respectively. The extent of contamination associated with this potential TCE source includes areas north and south of Buildings 69 and 74, east of Building 93, and along the south side of Vanowen Street. The relatively low concentrations of both TCE and PCE at point A38 (compared to sampling points on the east and west) may result from sampling this point under bare soil instead of asphalt or concrete. Hence, PCE contamination along this section of Vanowen Street is probably continuous.

The soil-gas data suggest the presence of a second source area located in the vicinity of Parking Lot 10A, where soil-gas concentrations exceeded 100 ug/L at five points. TCE concentrations of 47 and 20 ug/L were measured along the eastern walls of Buildings 85 and 85A; however, the data do not suggest whether these concentrations have resulted from a localized source or from TCE migration from a source north of Thornton Avenue. Additional sampling is required to define the origin of TCE in soil-gas in this section of the Plant.

Compared to PCE and TCE, TCA appears to be relatively limited in its distribution (at concentrations greater than 1 ug/L in soil-gas) within the areas surveyed. Similar to TCE, the highest TCA concentrations (1 to 19 ug/L) were recorded from sampling points in the northern portion of Parking Lot 10A. The origin of the TCA cannot be estimated from these data because the highest TCA concentration was analyzed at the northeastern most point, K32.

# Other Volatile Compounds --

Results of GC/FID analyses indicated that THC concentrations were above the 1 ug/L level at only two points within Plant A-1. A THC concentration of 750 ug/L was analyzed in soil-gas near the northwest corner of Building 65A (point A22), and a THC concentration of 13 ug/L was encountered west of Building 85 (point A07). As was the case in the B-1 Plant area, these THC values are probably a result of compounds other than chlorinated solvents. Benzene, toluene concentrations were below detection limits at both locations, suggesting hydrocarbon fuels are not the source of contamination. Oxygenated solvents such as methyl ethyl ketone and methyl isobutyl ketone may be present at these two locations.

### 4.2.3 Plant B-6 Area

The results of the Phase 1 soil-gas investigation did not indicate any areas of major VOC contamination within Plant B-6; however, fewer soil-gas probes were sampled during Phase 1 in the Plant B-6 area than in the other two areas. A source identification survey was conducted within Plant B-6 to assess whether potential sources were present.

### PCE Distribution --

PCE contamination of soil-gas within Plant B-6 was less than that observed within Plants B-1 and A-1, with respect to both concentrations and areal extent. The

highest PCE concentration measured within Plant B-6 was at the southeast corner of Building 371 where a PCE concentration of 350 ug/L was analyzed at sampling point A65. Concentrations of 65, 53, and 10 ug/L were encountered at locations to the north, northwest and west of Building 371 (points A64, B45, and B54, respectively). These points are located on either side of Hollywood Way and probably represent PCE migration from a single source rather than several distinct sources. Another location at which elevated PCE concentrations were measured is located south of Building 352 (16 ug/L at point 6B57); however, PCE contamination appears to be very localized in this region.

There were nine locations at which PCE concentrations were in the range of 1 to 10 ug/L, seven of which are located on either side of Hollywood Way within 1,000 feet of Building 371. The distribution and magnitude of these results suggest that they are due to PCE migration in soil gases along the street and not from liquid PCE contamination.

### TCE and TCA Distribution --

Slightly elevated TCE concentrations were measured in samples from north of Building 311 where concentrations ranged from 5 to 24 ug/L. Elevated TCE levels surrounding these points suggest that this area is near an area of soil contamination and that TCE may have migrated both to the east and southwest. A second potential source of TCE may be located to the southeast of Building 371. However, due to the relatively low TCE concentrations adjacent to Building 371 it is likely that soil-gas samples were not collected from TCE-contaminated soil.

The data suggest that suspect areas of TCA contamination may exist south of Building 352 and between Kenwood Street and Parking Lot 8, where soil-gas concentrations were as high as 160 ug/L. Similar to the distribution of PCE, TCA concentrations above 1 ug/L are located along the west side of Hollywood Way across from Building 371. A source of all three chlorinated solvents may be located adjacent to or east of Building 371.

### Other Volatile Compounds --

The results of GC/FID analyses indicate that total hydrocarbon concentrations did not exceed 1 ug/L at any soil-gas sampling point within the B-6 Plant.

# 4.2.4 Summary Of Suspect Contaminated Areas

The results of the Phase 6 soil-gas survey have confirmed several of the source areas which were identified from data collected during the Phase 1 investigation. Specifically, Phase 6 results suggest the following potential areas of soil contamination:

#### Plant B-6:

- o Area between Kenwood Street and Parking Lot 8 (TCA)
- o South of Building 352 (PCE and TCA)
- o North and west of Buildings 309 and 310 (TCE)
- o Southeast of Building 378 (PCE, TCE, and TCA)

- o South of Vanowen Street near Building 76A (PCE)
- o Building 93 and northeast of Building 74 (PCE and TCE)
- o North and east of Buildings 85 and 85A (PCE and TCE)
- o Parking Lot 10A (PCE, TCE, and TCA)
- o North of Building 65A and east of Parking Lot 14A (unidentified hydrocarbons)

### Plant B-1:

- o North and west of Buildings 175 and 180 (PCE and TCE)
- o South-southwest of Building 180 (TCA)
- o South and west of Building 125A (TCE)
- o Adjacent to Building 114D (PCE)
- o Area surrounding Buildings 140, 145, 139 and 123 and south of 140B (TCE and PCE)
- o South of Building 149 (TCE, benzene, and unidentified hydrocarbons)
- o East-northeast of Building 199 (TCE)

The location of soil contamination was assessed from VOC concentrations which exceeded approximately 100 ug/L (depending on the individual compound). This concentration level was selected on the basis of results from the Phase 1 investigation which indicated that higher VOC concentrations could not be attributed solely to vertical diffusion from groundwater.

Isolated sampling points which show anomalously high VOC concentrations compared to surrounding points are often indicative of gas-phase diffusion along a permeable subsurface layer. This phenomenon can result in high VOC concentrations at considerable distances from the source; however, these diffusion conduits can often be distinguished from actual source areas by the distribution of VOC concentrations at adjacent sampling points. These anomalous sampling points have generally not been classified as potential source areas, although they have been identified for possible further investigation.

# 4.2.5 Quality Assurance

See Section 2.2.4.

### 4.3 PHASE 6 CONCLUSIONS

Based on the results of the Phase 6 soil-gas investigation and on the objectives for evaluating subsurface contamination, the conclusions and recommendations listed below are provided. These conclusions and recommendations have been or will be implemented in subsequent phases of the soil-gas survey and in other tasks associated with LASC's comprehensive site assessment and remediation program.

o The Phase 6 soil-gas survey has provided a cost-effective, quick method for identifying possible soil contamination areas within the three plants surveyed. The soil-gas technique allowed reconnaissance of relatively large, otherwise unaccessible, areas of the LASC within a relatively short time frame.

- The Phase 6 investigation identified a total of 16 suspected contamination areas, on the basis of elevated VOC concentrations in the soil-gas. Four of the suspect areas are within Plant B-6, five are within Plant A-1, and seven are within Plant B-1. Whether elevated concentrations of VOCs measured in soil-gas from these areas reflect actual soil contamination or just gas-phase diffusion from contaminated soil remains to be established through confirmatory soil boring and sample analysis as well as through a records search to identify historical chemical handling and disposal practices and to locate high permeability conduits which could have resulted in vapor transport from distant sources.
- o The following have been identified as suspect areas warranting verification and assessment of the areal and vertical extent of any actual soil contamination:

### Plant B-6:

- East of Hollywood Way near Building 371

- North of Buildings 82 and 82A between Parking Lot 8 and Kenwood Street

#### Plant A-1:

- Buildings 93, 74, 69, and across Vanowen Street at Building 76A

- Northwest of Building 85A and north of Parking Lot 10A (Plant A-1 investigation is included in Phase 5)

### Plant B-1:

- Buildings 123, 139, 145, 140, and 140B

- Buildings 114D and 111 and southeast along corridor
- o The results suggest that areas which were surveyed but not specified are probably not affected by soil contamination or VOC diffusion from nearby sources. Low VOC concentrations measured in soil-gas from these "unaffected" areas may be indicative of contamination in the atmosphere and/or the underlying groundwater.
- o Analysis of ambient air samples collected on a regular basis during the soilgas surveying provides a method for quality assurance and data necessary to interpret results.

#### **SECTION 5**

#### REFERENCES

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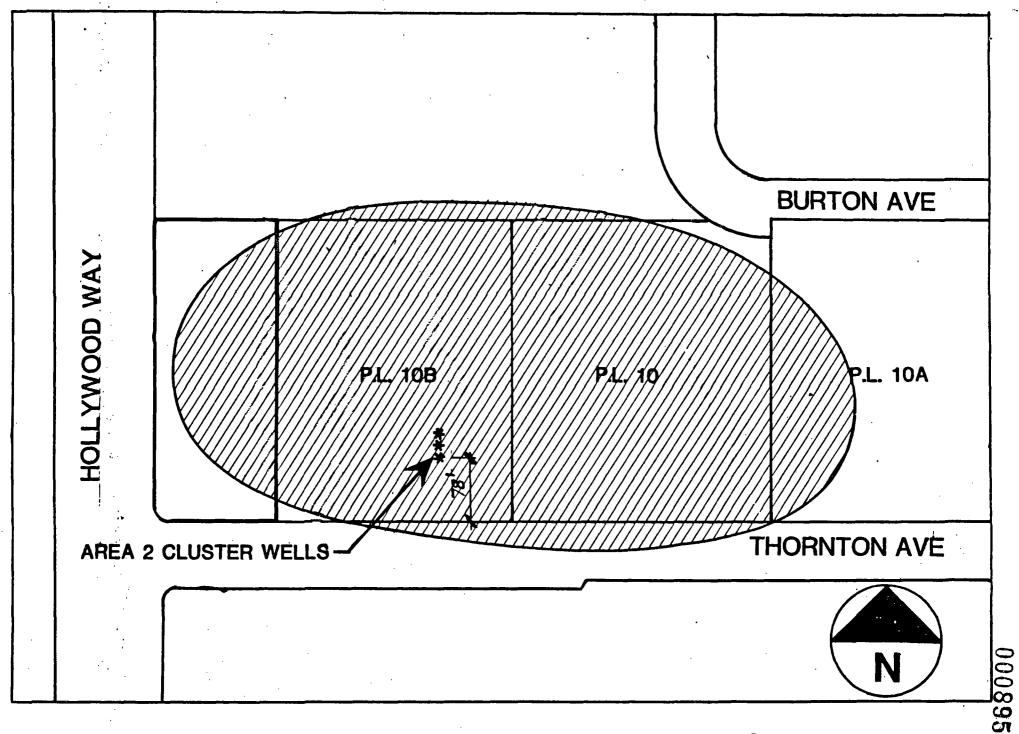


FIGURE 2 APPROXIMATE LOCATIONS OF AREA 2 CLUSTER WELLS



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# ENCLOSURE 2

AREA 2 GROUND WATER MONITORING WELL LOCATION MAPS, FIGURES 1 & 2

